

**Cryomagnets Interconnections** 

### Connection Cryostats

Status Sector 1-2 : Q19 L2 : Concrete repair – Short circuit

### Consolidation of sector 4-5

Plug-in Modules replacement (adapted strategy) DFB cables swap [F Savary] Overview - Status

### Quick interconnection overview



#### (Inter)Connection Cryostats Status

Sector	Repair of ICCs
1-2	Pending results of electrical investigation ; see next slide
2-3	Under repair ; end for beginning of W13
3-4	Start delayed (W11 to W12) End foreseen beginning W15 [Eastern, Open Days, in paral with 4-5]
4-5	L5 started ; end for W17 ; not priority
5-6	Afer warm-up (8th) - 3 units ?
6-7	Completed
7-8	Completed
8-1	Completed

Geometry is under control ; presentation by TS-SU/MME next week at MARIC



#### (Inter)Connection Cryostats Sector 1-2

- Yesterday morning (13/3): TP4-B1performed by ELQA (Preliminary test of the insulation at 50 V on main and spool circuits during the reparation of the connection cryostats)
- Short to ground detected on the MBA.A12 line of the dipole circuit.
- Fault localized between the dipole magnets at position C.19L2 and B.20L2.
- Connection cryostats not concerned by this problem.
- Diagnostics are ongoing to determine the exact location
- Closure of the ICC is proceeding anyway



#### (Inter)Connection Sector 1-2

Q19 L2 : [Documented in NC 890391]
Displacement of : Tilt : 1.5 mrad ; Longi. : - 5 mm
Systematic inspection launched by TS/IC
Gamma-rays of PIMs : OK
Concrete was repaired [TS/HE]
Test with vacuum on one side : OK
Busbars bellows deformed
Coincidence ?







### **Consolidation of sector 4-5**

**PIMs replacement** 



Sequence of operations (if reasonable # of collapsed PIMs) : First on 18/3 Ball test to localise failed PIMs (2 per beam line) to an accuracy of one half cell [4 per day] Opening of the QQBI IC of this sector [All sectors already vented but 1 with leak(s)] Measurements are taken to manufacture replacing PIMs Cutting of the PIM on both lines – Endoscopic inspection (+/- 100m) Installation of a replacement or dummy PIM - In parallel radar type measurement Loop to clear the whole sector Test of the photometer using c Time available for 24 PIMs In parallel, preparation of replacing PIMs Planned on 9-10/4 Rewelding of PIMs – Ball test to validate the sector Leak test of beam lines – Displace SSS downwards by 2 mm [Starting W13 but not a priority] **Reclosure of IC** Pumping and leak test of insulation vacuum – RF reference measurements Unknowns : Amplitude of the problem : Preliminary info next Tuesday / confirmed W13 So strategy to be applied ; if >> : systematic opening of IC and Gamma rays Type of PIMs affected : Preliminary info next Tuesday / confirmed W13 ICC 5/17**PIM WG** J.Ph. TOCK 15/02/2008

#### **Consolidation of sector 4-5**

Repair of 6 kA circuits in the DFBAs, [DFBLs and DFBMs]

M. Pozzobon, F. Savary, C. Urpin

## ICC 14<sup>TH</sup> MARCH 2008

ICC 15/02/2008

**Repair of DFBAs** 

6/17 F. Savary

## Scope of the work

 Intervene on the left/right sides of the ATM modules of the DFBAs, DFBLs and DFBMs

- Q7 to ATM module
- ATM module to HCM module
- Disconnect up to 5, out the 12, 6 kA connections
- Reconnect them with correct arrangement/grouping (one set of 3 cables shall include +, and neutral)
- Include all the necessary checks and recommissioning tests

## Example: case DFBAs



Figure 1. Schematic view of 6kA busbar routing in DFBAs

Courtesy A. Perin

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**Repair of DFBAs** 

8/17 F. Savary

## Preparation work on surface

- Launched at the beginning of last week
- To verify the technical feasibility
- **To estimate the amount of work and time needed**
- To provide hints to help decision
- To anticipate the necessary tooling and replacement pieces

## What has been done so far

#### Work carried out by

- Claude Urpin, Marc Pozzobon, Frédéric Kolakowski (FSU)
- Technical background recovered from Luc Oberli and Angelo Bonasia deeply involved during the production
- Mock-up recovered from the production in 183
- 12 connections were made
  - 3 of them insulated
  - 4 of each type
- De-brazing trials were carried out, one on the mock-up

**Repair of DFBAs** 

## Mock-up and method









15/02/2008





**Repair of DFBAs** 

11/17 F. Savary

## What's coming next?

- De-braze other 4 connections
- Re-braze the 5 connections and relocate them in the central region of the assembly
- ... with a mechanical support made out of insulation material
- Hopefully, ready by next Tuesday 18/3 evening

# Preliminary feedback

- Technically feasible?
- Easy?
- Risky?

- Will it possible to do the 2 sides, R4 and L5, in the 6 weeks given?
- Tooling "quasi" available

- Yes
- Certainly not!
- Yes
  - Spacer difficult to remove/put in place
  - We may provoke/reveal shorts to ground
- Not sure at all, one side yes. Probably 4 weeks needed per side

# **Options**:

#### "Use as is"

- ③: Commissionned system so no risk to introduce or reveal a defect
- 🙂 : Less work
- ③: Procedure will not be established and validated in-situ
- If intervention necessary later, will be in "radioactive" environment [Anyway for the other cases]

#### Repair both DFBAs

- © : Procedure will be established and validated in-situ
- © : Less interventions later in "radioactive" environment
- ③: More work, never done before in these conditions ; risk on schedule
- 🙁 : Risk to introduce or reveal a defect

#### Repair one DFBA and then ...

- © : Procedure will be established and validated in-situ
- © : Less interventions later in "radioactive" environment
- Elimited risk on schedule as only one intervention
- ⊗ : Risk to introduce or reveal a defect
- DECISION TO BE TAKEN SOON (Clock is launched): Next MARIC ? Difficult to balance "necessity" of intervention and risk to create or reveal a defect



#### Consolidation of sector 4-5 Leaks to repair Arc / Potentially recurring – Risk level : Low It was possible to leave with it so ...

#### Interventions :

- VACSEC 7R4 (NC847504) CM leak to insulation vacuum of 1 10<sup>-5</sup> mbar I /sec In DS zone, additional mobile turbo pumps are used Test are on-going ; will be independent from the rest of the arc
- VACSEC 15R4 C' K leak to insulation vacuum of 6 10<sup>-6</sup> mbar l /sec Disappeared during localisation ; leak not present anymore Sector vented
- 3. Check of beam lines leak tightness : on-going
- 4. Q17L5 and Q29R4 (NC 826696 and 820313) leak air to insulation vacuum temporary solution now but to be consolidated by AT-VAC

#### Risks / Unknowns :

- 1. Time for localisation Extra openings to support leak localisation work
- 2. New leaks created by/during warm-up

One None

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### **Consolidation of sector 4-5**

1	Plug-in modules	1 st ball test next Tuesday
2	Photometer test	Planned 9-10/4
3	Y lines	IC opened, strategy defined
4	Helium guards	Endoscopic inspection next Monday
5	Leaks	1 disappeared / 1 under localisation
6	Triplet 5L	QRL jumpers under cutting / in advance
7	Q5R4	Opening next Tuesday for investigation
8	Connection Cryostats	Started
9	CC splices	Not critical
10	DFBs cables	To be decided soon for DFBAs



### **Quick IC overview**

Sector	On-going
1-2	Short circuit / ICC repair
2-3	ICC repair
3-4	Repari of ICC delayed to next week
4-5	Consolidation started
5-6	Cold
6-7	Cool-down
7-8	Cool-down
8-1	Cool-down

17 ICs opened: 14 in the arc: 6 for CC, 8 in 4-5 3 in LSS : L5 triplet DFBX/Q3 + 2 jumpers

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#### LHC SECTORS OPENINGS FOLLOW UP

	1-2	2-3 2 R	3-6	4-5 4/2	5-6	6-7	7-8	8-1 8R
QDQI.7 R		415	415	414	-		115	100
QQBL7 R QQBLA8 R								
QBB18 R								
QBQL8 R								
QBB19 R								
QBQI.9 R								
QBBI.10 R								
QBQI.10 R								
QQBL10 R								
Q851.11 R Q851.11 R	_	OC I						
QEQI.11 R		CC						
QQBL11 R OBBLA12 R								
Q881.812 R								
QBQI.12 R								
QQBL12 R QBBLA13 R								
Q881.813 R								
QBQI.13 R 0.08 13 R								
QBBLA14 R								
QBBI.B14 R								
QQUI.14 R QQUI.14 R								
QBBLA15 R								
Q881.815 R								
QQBI.15 R								
QBBLA16 R								
QB01.016 R QB01.16 P								
QQBI.16 R								
QBBLA17 R								
QBQI.17 R								
QQBL17 R								
QBBLA18 R								
QBQI.18 R								
QQBI.18 R								
QBBLA19 R OBBLB19 R								
QBQI.19 R								
QQBI.19 R								
QBB1A20 R QBB1B20 R								
QBQI.20 R								
QQBI.20 R								
Q661.621 R								
QBQI.21 R								
QQBL21 R QBBLA22 R								
Q881.822 R								
QBQI.22 R								
QBB1A23 R								
QBB1.B23 R								
QBQI.23 R 0.08 23 R								
QBBLA24 R								
QBB1.B.24 R								
QBQ1.24 R QQB1.24 R								
QBBLA25 R								
0881.825 R								
QQBI.25 R								
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QBQ1.23 R								
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QBSLA29 R QBSL829 R								
QBQI.29 R								
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2661.630 P								
QBQI.30 R								
QQBI.30 R								
Q881.831 R Q881.831 R								
QBQI.31 R								
QQBI.31 R QBBI.432 P								
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QQBI.33 L								
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QBBLA32 L								
QBQI.32 L 0.08131 L								
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Q881A31 L Q80131 L								
QQBI.30 L								
Q881.830 L Q881.A30 L								
QBQI.30 L								
QBB1.B29 L								
QBB1A29 L QB01 29 L								
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Q881.828 L Q881.628 L								
QBQI.28 L								
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